On the Difference Between Social and Private Good

Citation for published version:
Kircher, P, Ludwig, S & Sandroni, A 2013, 'On the Difference Between Social and Private Good', *BE Journal of Theoretical Economics*, vol. 13, no. 1, pp. 151–177. https://doi.org/10.1515/bejte-2012-0008

Digital Object Identifier (DOI):
10.1515/bejte-2012-0008

Published In:
BE Journal of Theoretical Economics

DE GRUYTER doi 10.1515/bejte-2012-0008 — BEJTE 2013; 13(1): 151–177

Advances

Alvaro Sandroni*, Sandra Ludwig, and Philipp Kircher

On the Difference between Social and Private Goods

Abstract: Standard economic models have long been applied to choices over private consumption goods, but have recently been extended to incorporate social situations as well. We challenge the applicability of standard decision-theoretic models to social settings. In an experiment where choices affect the payoffs of someone else, we find that a large fraction of subjects prefer randomization over any of the deterministic outcomes. This tendency prevails whether the other party knows about the choice situation or not. Such randomization violates standard decision theory axioms that require that lotteries are never better than their best deterministic component. For conceptually similar choices in classical non-social situations, we do not find much evidence for such violations, suggesting the need for theories of uncertainty that are targeted to social settings.

Keywords: risky choice, betweenness axiom, social preferences, preference for randomness
JEL Classification: D81, C91, D63

***Corresponding author: Alvaro Sandroni**, Kellogg School of Management, Northwestern University, Evanston, IL, USA, E-mail: Sandroni@kellogg.northwestern.edu
Sandra Ludwig, Institute of Economics, Ulm University, Ulm, Germany, E-mail: sandra.ludwig@uni-ulm.de
Philipp Kircher, University of Edinburgh and the London School of Economics, E-mail: p.kircher@lse.ac.uk

1 Introduction

Behavior in laboratory experiments and in the field suggests that people care about perceived fairness. In fact, a decision maker, henceforth called Dee, may purchase fairness at material cost to her. The most straightforward way to incorporate fairness into economic analysis is to assume that Dee's utility depends only on

This article circulated under the title "Fairness: A Critique to the Utilitarian Approach".

outcomes, but outcomes may include what Dee obtains and also what others obtain. In the presence of uncertainty either about the environment or about other players, this outcome-based approach to fairness can rely on expected utility theory and has been the main theoretical and empirical focus of economists.

In this article, we highlight that Dee may choose to randomize over social outcomes even when it is unlikely that she is indifferent among alternatives. These choices are inconsistent with outcome-based models of fairness and they suggest that the use of expected utility theory (and well-known extensions) may lead to incorrect normative and positive conclusions when agents' choices directly affect others. This follows because such behavior clashes with elementary tenets of decision theory that have been (implicitly or explicitly) presupposed to hold true in mainstream economic analysis.

In an experiment where an individual affects both her own payoff and the payoff of someone else, we show that a large fraction (roughly 30%) of participants prefer to randomize rather than choosing one of the lottery's outcomes deterministically. This arises when the recipient is informed and randomization is costless, but similar results obtain if the recipient is uninformed or when randomization is costly. This conflicts with most theories of choice under uncertainty. In conceptually similar choice situations but where no other individual is affected, we do not find such effects (only 6% randomize). Thus, our analysis provides empirical support to theoretical developments that incorporate fairness in economics with new choice-theoretical foundations.

It may be useful to briefly clarify the notion of *outcome-based fairness in deterministic settings*. In standard decision theory, Dee must rank outcomes. However, the theory takes an agnostic view of why Dee prefers one outcome to another. So, in standard theory, Dee is not precluded from preferring less material wealth in order to improve the fairness of social outcomes. It follows that outcome fairness can be incorporated into economic analysis simply by defining Dee's utility $u(x)$ over an outcome x that not only includes Dee's own resources but also those of other people. Formally, with two players the outcome can include two components, i.e. $x = (x_1, x_2)$, where the first consists of Dee's own resources and the second of the resources of the other player.[1] It is perfectly conceivable that Dee's utility increases even with less own resources (lower x_1) if

1 The particular functional forms for the utility function that have been suggested differ. For example, Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) suggest specifications designed to capture inequality aversion. Charness and Rabin (2002) incorporate a concern for efficiency. Kirchsteiger (1994) incorporates envy. Each of these articles shows evidence that such specifications improve the ability to accommodate various dimensions of observed behavior, in particular if both fairness-motivated and selfish types exist.

the resources of the other player increase sufficiently (higher x_2). The main appeal of this approach is that outcome fairness can be incorporated into Dee's utility in a parsimonious and straightforward way, and it still leads to significant improvements over purely selfish specifications in the ability to accommodate several dimensions of observed behavior.[2]

This specification of preferences is formally identical to the classical setting in which Dee has to choose between any two goods (x_1 and x_2), only that in standard textbook analysis both goods are material goods (e.g. apples and pears, or money and coffee mugs) while here one good is a material good and the other is a "social" good. Realizing the commonality between "social" goods and consumption goods in these specifications, Andreoni and Miller (2002) apply tools from consumer theory and find that only a negligible fraction of individuals (2%) makes choices that cannot be captured by such a utility function.[3] This is similar to studies of choices for other consumption goods where violations of revealed preferences are usually rare.

Most applications of these theories consider *environments with uncertainty*. In line with the idea that choices in social and non-social situations are qualitatively similar, typical outcome-based fairness theories adopt the standard tools of expected utility theory. In contrast, we conduct experiments that challenge the perceived similarity between social settings and private consumption goods in settings with uncertainty. In particular, a substantial fraction (28%) of our participants that deal with a social situation elect to make randomized choices that are inconsistent with economic theories such as expected utility theory and most non-expected utility theories, independent of how exactly fairness is embedded in the preferences over final outcomes. However, we did not observe such behavior for participants that faced choices over private consumption goods (precisely, only for 6% of them). While the underlying reasons for Dee's choices, or any other private sentiment, can never be ascertained beyond doubt,

2 Andreoni and Miller (2002) find that only a quarter of the subjects display preferences that are consistent with pure selfishness, another quarter are consistent with either an equal split of resources or the most efficient outcome, and another quarter spend own resources to reduce the others' payoff in line with spite or envy. It should be noted that in our verbal explanations we often refer to the case where more resources to the other player increases utility, but this need not hold in general, similar to standard utility functions over non-social goods that need not increase with more of a particular good. None of our arguments hinges on the exact form of the utility function, and in particular it does not rely on the same utility function across individuals.

3 Andreoni and Miller (2002) vary the budget set and the price at which personal monetary payoff can be exchanged for higher monetary payoff of another person. They find that only 2% of subjects violate the weak axiom of revealed preference, which means that the choices of 98% can be represented by some utility function.

our experiments suggest that behavioral patterns may differ significantly depending on whether goods are private or social.

In order to make precise the nature of the mismatch between existing economic theory and our experimental results, we first point out that nearly all decision-theoretic models in economics presuppose that Dee will not choose some outcome x with significant probability if some other outcome y is available and Dee prefers y over x. In particular, let L be a lottery that assigns equal odds to sure outcomes x and y. Let $U(L)$ denotes the utility of the lottery, and $u(x)$ and $u(y)$ denote the utility of its sure outcomes x and y, respectively. Now, consider the following decision-theoretic property:

$$U(L) \leq \max\{u(x), u(y)\}.^{4} \tag{D}$$

Property D states that a lottery is not more desirable than its best final outcome. We call choice theories *outcome-based* if Property D holds.[5] This property is weaker than the betweenness axioms in Chew (1983) and Dekel (1986).[6] It is satisfied by a wide variety of models of choice that are routinely used in economics. In fact, if the decision is, say, whether or not to buy a regular good like a coffee mug, Property D seems so intuitive that it is difficult to see how it could not apply to most consumers. If Dee likes the mug, she buys it. If she does not like it, she does not. This seems to be consistent with our intuition about private goods. However, there are long-standing theoretical concerns about extending this basic intuition about private goods to social settings (see among others Harsanyi 1955, 1975, 1978; Diamond 1967; Fishburn 1988; Machina 1989).

Our work considers experiments on the validity of Property D with both social and non-social goods, in a setting as simple and intuitive as possible. Individuals are presented with three options: (1) to get more money; (2) to get less money

4 Gneezy, List, and Wu (2006) refer to a similar property as the "internality axiom".

5 In this definition, we restrict attention to tangible outcomes such as the joint monetary payoffs of all agents. In the discussion section, we return to this point and elaborate on larger state spaces where utility over outcomes may involve intangibles such as psychological states or beliefs (see, for example, Andreoni and Bernheim 2009; and Battigalli and Dufwenberg 2009).

6 It is weaker than the monotonicity axiom as it only refers to outcomes in the support of the lottery (i.e. elementary lotteries are considered) and not any other outcome. It is weaker than the betweenness axiom, because it does not involve compound lotteries. To compare with first-order stochastic dominance, the underlying space of outcomes first needs an order, which naturally arises by ordering outcomes by the utility $u(x)$ of the certain outcome. Such a notion is present for example in the ordinal first-order stochastic dominance approach in Spector, Leshno, and Ben Horin (1996) and in the approach to dominance in probabilities in Karni and Safra (2002).

and some other good; and (3) to flip a coin between these two alternatives, and we analyze which of these is revealed as the preferred one. Given that the decision-maker's payoffs are directly at stake, exact indifference between the first two alternatives would be an unlikely artifact of an exact choice of parameters.

To be more precise, in the social setting of the experiment, Dee has the choice between two alternatives, or she can also choose a lottery by which either alternative is equally likely. In alternative 1, she obtains more money than in alternative 2, but some other subject (that is passive) obtains less money in alternative 1 than in alternative 2. As argued earlier, choosing 2 over 1 can be interpreted as buying a social good at private expense. Like in other experiments, we observe that some subjects (28% of the population) prefer to sacrifice resources and choose 2. In itself, this is not a violation of outcome-based models and can simply be attributed to Dee having greater utility from buying the social good. However, we also observe that a substantial fraction of the subjects (28% of the population) chooses to randomize between the two alternatives. This is arguably of economically significant magnitude. So, many agents seem to value randomness beyond its determination of the final outcomes.

The (rather unlikely) scenario of a large indifference band, in which many agents are absolutely indifferent between their own consumption and that of the other person, would allow an outcome-based model to be consistent with these observations. As an additional robustness test, we conduct a treatment, in which randomization is costly, to rule out indifference as a full explanation for randomization. This treatment leads to similar observations as in our basic social good experiment without the penalty for randomization.

We do not intend a broad challenge of either outcome-based models in general or expected utility theory in particular. Rather, our results cast doubt on the applicability of standard models, such as expected utility theory, to social settings. To check this, we also ran an alternative experiment with different subjects. Here, Dee again chooses between two alternatives, 1 and 2, or a coin flip between them. But, in this experiment, the tradeoff is not money versus a social good. The tradeoff is between money and a private consumption good (a coffee mug).[7] The decision maker has the same amount of money at stake as in the social goods experiment. Alternative 1 yields more money but no mug, while alternative 2 yields a mug but less money. The proportion of subjects who keep the money turned out to be similar to the proportion that keeps the money for

7 In the tradition of Kahneman, Knetsch, and Thaler (1990), who analyzed the endowment effect with coffee mugs, we use coffee mugs, because there are no apparent norms in favor or against buying such mugs.

themselves in the social good setting, but the proportion of subjects who decide at random (6% of the population) is very small and statistically significantly smaller than in the case of the social good purchase. These results support the claim that the presence of social goods is conducive to behavior that standard economic models of choice cannot accommodate.

Dee's behavior is incompatible with standard theory, *regardless of her motives*. In fact, several possible explanations for her behavior suggest themselves. Dee may find randomization appealing, because she has a concern for procedural fairness in the sense that the process by which each outcome is reached (e.g. the flip of a coin) also matters to her.[8] Another plausible explanation is a notion of ex-ante fairness. That is, Dee wants to reduce ex-ante differences in outcomes and uses the lottery to achieve an intermediate split in expected surplus. The lottery thus serves as a device to overcome the indivisibility of the surplus. If her utility derived from expected outcomes is non-linear, it cannot be recast in terms of expected utility.[9] Fudenberg and Levine (2012) build on our experimental evidence and our informal argument that Dee's behavior is incompatible with most choice-theoretic models and, in particular, with expected utility theory. They provide a full-fledged proof that notions of ex-ante fairness are inconsistent with the independence axiom (and thus expected utility) and also with ex-post (outcome-based) fairness and, therefore, also with most axiomatized theories of social preferences. The axiomatized models of choice that can accommodate violations of Property D are quite recent, and some of them have been motivated by our findings (e.g. Borah 2009; Saito 2010).[10]

An alternative rationale for our observations is that randomization presents Dee in a better light in front of a receiver. This explanation can be challenged, because we also find a similar tendency for randomization in situations with uninformed receivers (a charity), so that signaling to the receiver is excluded. We discuss possible motives in greater detail later. For now, we just point out that while violations of expected utility theory are not new, these violations are typically much less blunt than the violation of Property D that we find here.

In terms of *literature*, the classical violations of expected utility fall mainly into two categories. Going back to Allais (1953) and Kahneman and Tversky

8 This subsumes motives like shifting responsibilities as, for example, observed by Bartling and Fischbacher (2011) and Hamman, Loewenstein, and Weber (2010).

9 If the utility of a lottery L over outcomes $x = (x_1, x_2)$ specifying the realization for each of two players can be written as the utility over expected realizations $U(L) = u(E_L(x_1), E_L(x_2))$ with u non-linear, then it cannot be represented as expected utility $U(L) = E_L\tilde{u}(x_1, x_2)$ for any function $\tilde{u}$ because this is linear in probabilities.

10 See also Chew and Sagi (2006), Grant (1995), and Grant et al. (2010) for related work.

(1979), it has been recognized that people may not properly compound lotteries (lotteries that involve sublotteries) into simple lotteries (lotteries only over final outcomes). Going back to Ellsberg (1961) it has been documented that people evaluate lotteries with known probabilities differently than lotteries where the probabilities are unknown (usually referred to as ambiguity aversion). In contrast, the observed behavior here is unrelated to potentially complex operations such as compounding lotteries or assessing odds. Our setup is kept deliberately as simple as possible: Individuals are fully informed about the probabilities. The 50–50% lottery is simple and arguably familiar to subjects. The outcomes are deterministic and not sublotteries. In this sense, our observed violation of Property *D* is more elementary than the classic violations of expected utility. A similar challenge – yet not related to social settings – is posed by Gneezy, List, and Wu (2006) who argue that people may value a lottery strictly less than its worst outcome with certainty.[11] We document the opposite phenomena: a tendency in favor of randomization, which is confined to social settings.

Recently, several challenges to expected utility theory that specifically consider the social context of the decision have been documented (see Cooper and Kagel, forthcoming, for an overview). These contributions provide valuable insights into potential shortcomings of expected utility theory, but they do not directly compare social and private consumption goods. Moreover, they are generally more complex and do not formally challenge the basic Property *D* directly. We provide an extensive comparison after laying out our experiment and so confine ourselves here to a brief mentioning of some contributions: Bolton, Brandts, and Ockenfels (2005) adopt the term procedural fairness to describe the motivation of receivers in an ultimatum game to reject (unfair) offers more often when a preceding lottery is unbalanced or when a fair offer would have been available. Their focus is on the acceptability of unfair outcomes and not on choices under risk. In contrast, our results directly challenge the standard decision-theoretic models. Bolton and Ockenfels (2010) show a conflict between inequality aversion and expected utility theory, but their findings also do not violate expected utility in general as we discuss later. Other studies show violations of expected utility theory in complex settings which do not allow a direct test of Property *D* (below we discuss Brock, Lange, and Ozbay 2013; Karni, Salmon, and Sopher 2008; and Krawczyk and Le Lec 2008 in detail). Finally, Andreoni and Bernheim (2009), Dana, Cain, and Dawes (2006), and Tadelis (2008) document incentives of a sender to hide his actions from a receiver.

11 See, however, Keren and Willemsen (2009), and Rydval et al. (2009), for empirical evidence suggesting that Gneezy et al.'s findings may not be very robust.

In contrast, our findings arise both when the receiver is fully informed and when the receiver (a charity) knows nothing of the decision situation, suggesting that signaling to the receiver is not the driving force behind our results.

In contrast to those studies, our contribution is to analyze in the simplest possible setting whether violations of Property D are a general phenomenon or are rather specific to a social context. Our results suggest that violations of this basic axiom of decision theory occur mainly in social settings. It might be worth noting that a difference between consumption and social goods should not exist under standard economic theory: choices should display a common structure, despite the fact that the goods are very different. Under standard economic theory, we can assign a subjective numerical value (i.e. the utility) to each outcome, and the person should make the choice associated with the higher number (i.e. maximization of utility) rather than randomize. In addition, the difference in the fraction of people who randomize (in social and private goods settings) does not seem to be driven by differences in tendencies to keep the money. When the monetary stakes for the decision-maker are equivalent in both settings, it turns out that the fraction of people who choose to keep the money is similar in both the social and the private good experiments. While this is not a proof that a similar violation cannot arise for private consumption goods (such a proof is obviously not possible), we find that randomization occurred more frequently with social rather than private goods for several monetary stakes. These results suggest a challenge that is specific to social settings.

Our results support a long-standing suspicion among decision-theorists that choices in social situations differ in important ways from choices about consumption goods. In the following, we briefly review the classical suspicion that social outcomes may put reasonable subjects' decisions at odds with classical decision theory. We then present the details of the experiment and our findings, before returning to a more thorough discussion of the literature that includes connections to classical decision theory, details on related experiments, new theoretical efforts partially motivated by these experiments, and some assessments of the motivations for randomization in social situations.

2 Background: a classical thought experiment

Property D is intuitive if the decisions are about consumption goods, but less consistent with intuition about social goods. When decisions affect other people as well, Dee may care not only about final consequences but also about the means by which the consequences were produced. This argument is far from original and can be traced back to early decision-theorists. A thought experiment by Machina (1989) sums up a long-standing discussion on interpersonal fairness that he traces back, among others, to Harsanyi (1955), Diamond (1967), and Broom (1984).

Assume that Dee has two children and one indivisible toy. Dee can decide which of her children gets the toy or she can flip a fair coin to make this determination. Dee may strictly prefer the coin flip if it seems (to her) that this is a less partial procedure than giving the toy to either child deterministically. So, a coin flip may be desirable if it is seen as a fair procedure. Yet, this directly violates Property D, no matter how the utility of each outcome is defined. Hence, one cannot accommodate the behavior described by Machina by incorporating fairness concerns directly in the utility $u(x)$ of each outcome – except for the case of indifference between both deterministic allocations. This follows because Dee may see an outcome differently depending on how it was produced; either deterministically or as the outcome of a fair coin. This thought experiment seems (to us) a natural starting point for the development of a new research agenda on fairness. A basic question is whether this behavior is present in real life.

Even though this thought experiment is well-known, empirical research on this idea is rather sparse.[12] This may be partially due to the unusual feature that in this thought experiment Dee makes the decision over the outcome of two *other* people and that there are no direct monetary consequences for her. This may raise the concern that violations of Property D occur in the rather special circumstances in which Dee is indifferent over the lottery's outcomes. In our experiment, we consider a related environment in which Dee is one of the two recipients and, therefore, *Dee is directly involved in the lottery's outcomes*. This makes the possibility of indifference, though theoretically possible, rather implausible, because it would entail an accidental choice of the exact values that produce indifference. As aforementioned, we also conduct a treatment in which randomization is costly to rule out indifference as an explanation. Similarly, possible motivations for her choice such as signaling to herself or the receiver become more relevant when Dee is directly involved.

12 Since we are not aware of an implementation of this thought experiment, we included hypothetical versions of Machina's parental example in another, unrelated experiment. We asked 56 participants to imagine they are a mother with 2 kids and to have only 1 candy. They had to decide whether to give kid 1 or kid 2 the candy or let a coin toss decide. About 95% chose the coin toss. One hundred and one participants faced a modified version, in which we tried to break indifference: the mother now has a green candy and knows that kid 1 likes green candies best, while kid 2 likes red candies. Here, still 67% choose the coin toss and the remainder to give the candy to kid 1.

3 The experiment

Our experimental sessions were run at the Munich Experimental Laboratory for Economic and Social Sciences (MELESSA) in Germany in 2008. 388 individuals participated in the experiments, of which 248 were assigned to experiments with a social good and 140 to experiments with a private consumption good. Most of them are students at the universities of Munich. Assignments to experiments and sessions were random, and individuals could take part in one session only. Participants were recruited via e-mail using the software ORSEE by Greiner (2004). The experiment was programmed and conducted with the software z-Tree by Fischbacher (2007). The sessions lasted about half an hour. Subjects were randomly assigned an individual computer terminal in the laboratory. They could not see other subjects' decisions. Individuals were handed out the instructions for the experiment and had time to go through the instructions on their own and ask questions.[13] After all individuals had finished the instructions, and all remaining questions had been answered, they proceeded to the decision stage. Payoffs were expressed in the experimental currency Taler and were converted at a known exchange rate to Euros at the end of the experiment (at the time of the experiment 1 € $\approx$ 1.57 USD).

3.1 The "social good" experiments

3.1.1 Basic social good experiment

To analyze whether concerns for fairness induce a preference for randomization, we conduct the following modified dictator game experiment with 92 participants. Participants are randomly matched into groups of two. In each group, one participant (Dee) has the choice between two alternatives 1 and 2, or she can choose a lottery by which either alternative is equally likely, while the other participant makes no payoff relevant decision.[14] Alternative 1 means that Dee receives 7.50 € and the participant matched to her receives 0 €. Alternative 2 means that both Dee and her matched partner receive 5 €. Hence, Dee's decision is whether she wants to give up 2.50 € such that her matched participant receives 5 € (i.e. "to buy the social good") or not, or whether she wants to randomize.[15] The matched partner is

13 Original instructions are written in German and are available from the authors upon request. See the Appendix for translated instructions.
14 The random allocation to a cubicle also determined an individual's role in the experiment.
15 We chose the magnitude of these payments to be well within the range used in other experiments on social preferences.

informed about Dee's decision problem and learns her decision in the end of the experiment. In an outcome-based view, Dee has a preference for one of the two certain outcomes: alternative 1 or 2. If preferences satisfy Property D, randomization leads to a lower utility than one of the two certain outcomes. Thus, outcome-based models cannot accommodate choices of the lottery – except for the case of indifference between alternatives 1 and 2.

We observe that most decision makers (44%) choose to keep the money (alternative 1), while as many choose to randomize as to buy the social good (28%).[16] Hence, almost a third of the participants show a revealed preference for randomization which we take as evidence for systematic violations of Property D and thus of all outcome-based choice theories. Note again that this conclusion presupposes that participants are not predominantly indifferent between both deterministic allocations. To rule out indifference as an explanation for the choice of the lottery, we conduct an additional experiment in which we place a small price on choosing the lottery, such that indifference between the deterministic allocations can no longer explain randomization (see below).

One may wonder whether individuals who violate expected utility theory (EUT) in other situations are particularly prone to violate Property D. Therefore, the decision makers (Dee) in the basic social good experiment were asked after their decision to make standard hypothetical Allais-Paradox-lottery choices.[17] While 35% of the subjects violate EUT in the Allais-lottery choice, only one subject (2%) also violates EUT by choosing to randomize. Hence, we do not find evidence that subjects are prone to violate EUT in both situations.

3.1.2 Robustness check "social good with costly randomization"

Indifference between both deterministic allocations could explain the choice of the lottery in the social good experiment. Hence, we additionally conducted a treatment with 96 other participants in which randomization was costly. We kept the design as similar as possible to the baseline social good experiment. The main difference being that choosing to randomize between alternatives 1 and 2 decreases Dee's prize and the receiver's payoff by 0.10 €. In order to ensure that the receiver's payoff remains positive when Dee randomizes and alternative 1

16 On average, participants earned 9.4 € including a 5 € show-up fee.
17 The first choice is between the lotteries L_1: 500,000 € with 100% and L_2: 2.5 million € with 10%, 500,000 € with 89% and 0 € with 1%; the second between L_1: 500,000 € with 11%, 0 € with 89% and L_2: 2.5 million € with 10%, and 0 € with 90%. A violation of EUT involves choosing L_1 in one situation but L_2 in the other.

realizes, we had to adjust the receiver's payoff for alternative 1. Alternative 1 still means that Dee receives 7.50 € but now the receiver obtains 0.50 €. Alternative 2 still means that both Dee and her matched partner receive 5 €. When Dee chooses the lottery, both her and the receiver's payoff are reduced by 0.10 €. If preferences satisfy Property D and more money is preferred, randomization now leads to a strictly lower utility than either of the two certain outcomes even in the case of indifference between alternatives 1 and 2.

We observe that most decision makers (46%) choose to keep the money (alternative 1), while a third buys the social good and 21% choose to randomize. Hence, even if randomization is costly many participants show a revealed preference for randomization. Comparing the fractions of subjects that randomize in the treatment with costly randomization and in the baseline social good experiment (bundling those who do not randomize), a chi-square test indicates no significant difference ($p = 0.402$).[18]

3.1.3 Robustness check "social good with uninformed receiver"

Some of the literature on social preferences (as aforementioned) discusses the importance of whether choices are visible or can be hidden from receivers as people may care about how they are perceived by the receiver. In our basic social good experiment, the receiver knows Dee's decision problem and always learns her decision. Thus, choices are always visible. As a robustness check, we conduct an experiment, in which the receiver of the money is completely uninformed about the choice situation, which largely excludes motivations based on the desire to be perceived favorably by the receiver. More precisely, the recipient is a charity (the German Red Cross). We have chosen a charity for two reasons. First, this has the advantage that the charity (and its beneficiaries) is obviously uninformed of the choice situation (and the decision maker's identity), so that there is no need to make this feature a salient part of the experimental instructions.[19] Second, we do not need another subject as the recipient which allows us to obtain twice as many observations. Note, however, that it does not matter for the purpose of this robustness check whether or not the receiver is another subject or a charity since he/she does not make any decision in the experiment – what matters is that there is a receiver who obtains the money and is uninformed of the decider's decision.

18 A chi-square test comparing all three options also yields no significant difference ($p = 0.686$).

19 If we had chosen another individual as the uninformed receiver, we would have had to make sure in the instructions that the subjects know and believe that the receiver is indeed uninformed.

We included the following donation choice in another, unrelated experiment (before subjects knew their payoffs): 60 participants decide whether they want either to receive 1 additional Euro or to donate the Euro to the German Red Cross, or whether they want to randomize between the two alternatives. Most decision makers (52%) choose to keep the money. Again, a significant fraction (25%) randomizes. The remainder buys the social good (23%). The large fraction choosing to randomize highlights that randomization is unlikely to be due to exact indifference, as we chose different parameter values as in the previous setting. More importantly, while the results of the donation choices suggest that signaling to the receiver is not the driving force behind our observations, we cannot rule out signaling to the experimenter or self-signaling. However, signaling to the receiver is the main thrust in several current experiments (e.g. Andreoni and Bernheim 2009; Dana, Cain, and Dawes 2006) as aforementioned.

3.2 The "private consumption good" (mug) experiments

Three important questions arise in the context of the previous findings. Do people have a general propensity to randomize, for example simply due to "mistakes" or "trembles"? Are the monetary stakes too low for them to care about the choice? Or might they generally prefer to randomize even in non-social settings where normative aspects are less pronounced? To get a first insight, we conducted experiments in which no social concerns are present but which are otherwise as similar to the basic social good experiment as possible. In these experiments, 140 other participants were asked to decide whether to buy a classical private good (a coffee mug).

3.2.1 Basic private good experiment

From a 7.50 € show-up fee, 48 participants had to decide whether to give up 2.50 € to get the mug (including three tea bags), or to keep the entire show-up fee and forgo the mug, or to randomize between both options.[20] We kept the personal cost of the private good at 2.50 €, which corresponds to the 2.50 € personal cost of the social good before. In the beginning of the experiment, we show subjects the mug and tell them that it is only available at the online shop

20 Individuals made the mug choice before they knew their earnings. Since the mug choice is so trivial, they made in addition a decision in an unrelated voting experiment in which they could earn 0, 7, or 10 Euro. The complete (translated) instructions are in the Appendix.

of the Ludwig-Maximilians university of Munich at a price of about 6 €. In the Appendix, we show a picture of the coffee mug.

We observe that 54% do not buy the mug, 6% randomize, and 40% buy the mug. The fraction of people randomizing is very small. Figure 1 shows the results of the basic social good and the mug experiment. A Fisher exact test indicates that the fractions of subjects that choose to randomize or not (i.e. bundling those who do not randomize) differ significantly across experiments ($p = 0.004$, one-sided).[21] If we compare the mug experiment with the social good experiment with costly randomization, the fractions of subjects that randomize still differ significantly (Fisher exact test: $p = 0.035$, one-sided). The fractions again differ significantly, if we compare the mug experiment with the social good experiment in which the receiver is uninformed (Fisher exact test: $p = 0.029$, one-sided).[22] One might argue that the stakes in the experiment are such that one of the deterministic options is too attractive and therefore people do not randomize. We observe, however, that many people buy the mug and also many people do not buy it. Thus, the stakes do not seem to prevent randomization in general by making one option much more attractive than the other option.

3.2.2 Robustness check "private good with different stakes"

Moreover, we assess the robustness of the finding that people tend to decide deterministically when the good is a private good by varying the stakes. We conducted two additional private good treatments with 92 other individuals in which we varied the price of the mug and the included accessories (the tea bags), while everything else remains unchanged. In no treatment did more than 11% of the individuals randomize. First, we conducted a treatment (48 participants) with identical monetary stakes of 2.50 € but changed the return by leaving out the tea bags. We then additionally lowered the monetary stakes to 1.50 € (44 participants). At the price of 2.50 and without the tea, very few people bought the mug (83% did not buy, 8% randomized), at 1.50 and without the tea the fractions are comparable to the setting reported (34% buy, 11% randomize).

21 Given the small number of subjects that randomize in the mug experiment, a Fisher exact test seems more appropriate than a Pearson chi-square test. The latter however yields a similar result ($p = 0.005$). Instead of bundling those who take the money or buy the good, we can test for a relation between experiments using all three choice options (randomization, take the money, or buy the good). Again, both tests indicate a significant difference (Fisher exact test: $p = 0.016$; Pearson chi-square test $p = 0.017$).

22 However, in the latter two comparisons, the social good experiment differs from the mug experiment due to the cost of randomization and the receiver being a charity.

The clear difference to the social goods setting can also be quantified statistically by comparing the fraction of randomizations between the basic social good experiment and any of the three mug treatments. All three comparisons show significant differences (Fisher exact tests: all $p < 0.04$, one-sided). We take this as an indication that neither a propensity to "tremble" nor a general preference for randomization can explain the choices in the social good experiment.

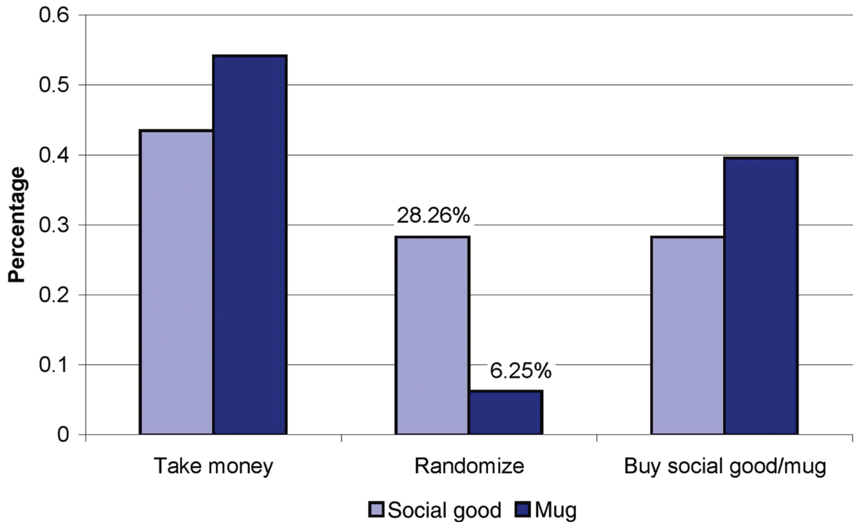

Figure 1: Social good vs mug decisions.

We cannot rule out that people may have a better sense for their value of the mug than for giving to another person in an unfamiliar laboratory setting. Yet, we find similar results in the experiment where the recipient is a well-known charity, which might suggest that unfamiliarity is not a major issue. Another indication that unfamiliarity or additional cognitive costs might be less of an issue is that subjects do not need more time to make their decisions in the basic social good experiment than in the basic private good experiment.[23]

In sum, choices in the social and in the classical private goods settings should display a common pattern in standard theory, despite the fact that the

23 Mann–Whitney U tests do not indicate significant differences: $p = 0.4048/0.8157/0.4550$ when testing decision times for all three choice options/for those who keep the money/for those who buy the social good or the mug. Since too few people choose to randomize in the mug experiment, we cannot test for differences in the time for randomized choices.

goods are different. While no experiment can conclusively demonstrate that any theory is valid, the experimental evidence can provide a useful benchmark for comparisons between settings. We found significant violations of standard economic models (due to randomized choices) in social good settings, but we did not find similar violations in private good settings.

Our central point is that, in the social setting, it is difficult to reconcile the observed behavior with several choice-theoretic models regularly used in economics. The underlying motivation for these choices may be: (1) a concern for procedural fairness; (2) a preference for ex-ante fairness/reducing ex-ante differences; (3) signaling about one's own type to one-self; (4) various emotions such as shame and envy; and (5) signaling of one's type to the passive recipient. Finally, the possibility that subjects are indifferent between all options does not seem to fully drive the choice of the lottery, as our robustness check with costly randomization suggests. The first four reasons are difficult to distinguish even conceptually, because they are all based on internal sentiments that are not directly observable. Thus, we did not attempt to differentiate them empirically. The fifth alternative, signaling to the receiver, is fundamentally different from the others and has received significant attention in recent studies on fairness preferences (see among others as discussed below Dana, Cain, and Dawes 2006; Dana, Weber, and Kuang 2007; and Andreoni and Bernheim 2009). This explanation, however, is difficult to reconcile with the version of our experiment where the receiver (a charity and its constituents) is not aware of the choice situation. While we have not implemented this session double-blind (i.e. the experimenter is informed on choices) the fact that the choice pattern hardly changes whether or not the receiver is aware of the choices suggests that signaling to others may not be the driving force behind our results.

4 Relation to the existing literature

4.1 Non-social situations

There is a large literature on individual choice under risk demonstrating empirical violations of linearity in probabilities of preference functions or, equivalently, violations of the independence axiom (for a review, see e.g. Machina 1987). The evidence of systematic violations led to generalizations in the form of non-expected utility models (see Starmer 2000; Machina 1987; and Weber and Camerer 1987, for overviews). These models satisfy Property D and, hence, are at odds with the behavior observed here. Several other well-known theories of behavior also satisfy

Property *D* (see, for example, prospect theory (Kahneman and Tversky 1979), weighted utility theory (Chew 1983), implicit expected utility (Dekel 1986), and disappointment theory (Gul 1991)). Unlike our results, empirical violations of betweenness obtained can be attributed to difficulties in compounding lotteries, see Camerer and Ho (1994) for a survey and evidence.[24] Hence, these violations of expected utility are less elementary than the one reported here.

Yet the focus of this literature is very different from ours. In none of these studies, social concerns are considered as a possible root cause of the observed violations. Hence, comparisons between results obtained with social goods and results obtained with private goods only (a focus of our analysis) are not conducted in these studies.

4.2 Social situations – theoretical explanations

The vast majority of contributions on social preferences relies on incorporating social concerns directly into the utility functions.[25] Applications of these theories to settings with risk generally rely on expected utility theory. Clearly, our results challenge these outcome-based models.

Recently, some decision-theoretic formalizations have emerged that can accommodate the violations of Property *D* that we observe. Karni and Safra (2002) consider individuals with two preference relations, one over the personal material well-being and one over the fairness of the lottery, and violations of Property *D* can be rationalized due to the second one. Grant et al. (2010) constructed a generalized utilitarianism model that confronts a similar critique of standard theory that we addressed here (i.e. that randomization may promote fairness). Borah (2009) produced an axiomatized model of behavior that embeds procedural fairness and can accommodate violations of Property *D* based on a concern for counterfactual outcomes.[26] In Saito (2010), an individual's concern for equality in expected payoffs rationalizes preferences for randomization. Our experimental design is very much in the spirit of these theories, and the models in Borah (2009) and Saito (2010) have, in turn, been influenced and motivated

24 Generalizations which do not assume betweenness are those in the quadratic class (e.g. Machina 1982) and those in the rank dependent or cumulative class (e.g. Quiggin 1982).

25 See e.g. Kirchsteiger (1994), Levine (1998), Fehr and Schmidt (1999), Bolton and Ockenfels (2000), Ok and Kockesen (2000), and Charness and Rabin (2002) for specific functional forms. See, e.g., Maccheroni, Marinacci, and Rustichini (2008), Sandbu (2008), and Rohde (2010) for specifications founded in the axiomatic tradition of decision-theory.

26 See also Neilson (2006).

by our results. A central objective of this paper is to give empirical support to theoretical efforts.

A simple functional form that may capture the type of behavior that we find is based on a reversal of the expectations operator: rather than having expected utility only over final outcomes, agents might have utility over the expected payoffs that each player obtains (see for example Trautmann 2009). This could rationalize the behavior since some agents might want to leave something, but not all, to the receiver. In expectation, they can achieve this via the random draw.

Alternatively, a strand of the literature has moved beyond tangibles and assumes that utility depends on the (endogenous) ex-post beliefs that Dee holds about her own type and the type of others (e.g. Andreoni and Bernheim 2009; Battigalli and Dufwenberg 2009). So, if Dee thinks that randomization may signal something favorable about her, then she might randomize over the deterministic actions and violate Property *D*. However, the aforementioned donation choices largely exclude signaling to the receiver (the German Red Cross).[27] Yet, we still observe that many subjects randomize and the fraction of subjects who randomize is of a similar magnitude than in the basic social good experiment. So, as we mentioned above, signaling to others does not seem to be the only driving force behind randomized choices.

4.3 Social situations – experiments

Despite hundreds of studies on social preferences, so far only a handful of experimental papers deal with risk. They differ in the level of complexity of the experimental design; do not directly consider Property *D*; and rarely compare social and private consumption goods.

Bohnet and Zeckhauser (2004) and Bohnet et al. (2004) document that individuals choose a safe option more often over a risky option if the risk is induced by another person's (unknown) decision rather than some known exogenous randomization device. This does not explain randomized choices, and most of their interpretation is grounded in expected utility theory. When randomization is imposed by an exogenous device, they do not find evidence that choices change whether or not the payoffs of the other person are affected. Moreover, even if choices had changed when the payoffs of the receiver were affected, this would not have violated Property *D* and could simply be explained by a concern for the receiver's payoff.

27 Since these works were concerned with signaling to the receiver, the settings were not double blind. Neither was our experiment. That leaves open the possibility of signaling to the experimenter.

Bolton and Ockenfels (2010) consider a dictator game where the dictator has the choice between a risky and a safe option. They find that dictators choose the safe option more often when it entails less inequality. However, they do not find that people choose the risky option more often when the outcomes of the risky option entail less inequality. They point out that this is consistent with the view that the risky lottery constitutes a "fair procedure". Their findings show that expected utility theory together with inequality-averse outcome-based preferences does not account for the data. Unlike the results in this article, though, their results do not lead to a direct contradiction of expected utility theory in particular or Property D in general, since it is possible to assign utility values to the outcomes that rationalize these choices.[28]

Other studies have considered settings in which the action chosen by the sender is not directly revealed to the receiver, either because she cannot distinguish the action from the outcome of some random draw (Andreoni and Bernheim 2009; Charness and Dufwenberg 2011; Tadelis 2008) or because the sender can actively hide the action (Dana, Cain, and Dawes 2006). In these studies, senders seem to conceal selfish actions from the receiver, and receivers reject unfair offers less if they are less able to attribute them to the sender.[29] These studies are based on private information and differ from our setup where all actions are made common knowledge. Also, none of the papers directly challenges Property D.[30] An exception may be one treatment in the work of Dana, Weber, and Kuang (2007). In that treatment, participants know that delay in their response makes it more likely that the computer takes the decision based on a random draw (and the receiver was not told who decided).

28 In Bolton and Ockenfels (2010), depending on the treatment, the outcomes of the safe option are (7,7), (7,0), (7,16), (9,9), (9,0), or (9,16) – where in each case the first (second) entry denotes the dictator's (receiver's) payoff. The outcomes of the risky option are either (16,16) and (0,0) or (16,0) and (0,16). Since the outcomes of the safe option differ from the outcomes of the risky choice, it is possible to assign utility values to the outcomes that rationalize the findings even within the framework of expected utility theory. Whether such utility values reflect one's intuition about fairness or inequality aversion is a different matter.

29 Bolton, Brandts, and Ockenfels (2005) study a different environment and document that responders often reject unfavorable offers if the sender could have chosen an unbiased offer, while the rejection rates go down substantially if no unbiased offer is in the choice set of the sender. This part of their study does not deal with preferences for randomization directly, though.

30 In Andreoni and Bernheim (2009), decision makers do not choose among lotteries, but choose after the lottery is executed. Charness and Dufwenberg (2011) and Tadelis (2008) have decisions only between one deterministic outcome and one lottery. Dana, Cain, and Dawes (2006) and most of Dana, Weber, and Kuang (2007) consider settings without uncertainty.

Albeit different in setup, surprisingly their findings come out similar to ours: roughly 30% of the subject act late and their decisions are taken by the computer. However, all these studies highlight the importance of imperfect information that the receiver has about the actions of the sender. In contrast, we find a tendency to randomize both when the receiver is fully informed about the sender's choice (even when he chooses randomization) and when the receiver is a charity that has no information about the choice situation at all.

Bolton, Brandts, and Ockenfels (2005) suggest that people have a concern for procedures. They focus on the receivers in an ultimatum game and the acceptability of (unfair) offers. Their work does not test Property *D* as the receiver decides between deterministic outcomes.

In Brock, Lange, and Ozbay (2013) and Krawczyk and Le Lec (2008), individuals face a sequence of deterministic and stochastic dictator games in which the dictator can choose any split of the surplus (in deterministic or stochastic terms, depending on the choice situation). In the stochastic dictator games, some individuals choose an interior probability. However, subjects have to compound the lottery of the stochastic offer with the lottery over the game that is chosen for payment. The compound nature of the probability does not allow for a direct test of Property *D*.

Finally, Karni, Salmon, and Sopher (2008) consider 3-person dictator games and focus on whether a subject cares about the inequality and (procedural) fairness between the two other players. They find that a substantial fraction of subjects is willing to give up some probability of getting a prize to reach a fairer allocation procedure. Their framework is complementary, but substantially more complicated than ours, and without available alternatives that give sure outcomes, it does not directly speak to Property *D*.

Our setup was designed to be as simple as possible, without compounded lotteries, and with only a very limited number of easily understandable choices. We chose to restrict attention to two final outcomes only. This allows an easy comparison to basic theoretical predictions. It also makes the setting particularly tractable for the participants.

The restriction to two outcomes involves an indivisibility of the surplus. If participants can choose (deterministically) any intermediate split of money, they may choose an intermediate split instead of randomizing, for example because they care about the ex-post fairness of their choice. We do not want to claim that people behave in an ex-ante or procedurally fair way if they can reach ex-post fairness. Yet, in many relevant social and economic situations, only few outcomes are feasible (e.g. promoting an employee or not, bequeath of managerial rights within family or outside, acceptance or rejection of proposals, and voting between few alternatives). In these cases, a deterministic split is not feasible and violations of expected utility theory may still have a large impact.

Unlike most previous empirical studies, we assess the magnitude of randomization relative to other (non-social) choice situations. This approach rules out the idea that individuals have a general propensity to randomize, because for private goods a revealed preference for randomization is nearly absent. This suggests that social concerns are the root cause behind randomization.

5 Conclusions

Fairness concerns have attracted increasing interest in the economics literature. Among other areas, they are important in family economics, charitable giving, and political economy models of social transfers. A central part of the research agenda is to find preference specifications that allow a parsimonious representation of the key elements of social concerns. In this article, we challenge the view that outcome-based models can fully account for social concerns. When a social good is present, we find significant violations of an elementary property of standard (outcome-based) economic theories of choice. The ultimate reasons for the observed behavior cannot be conclusively ascertained, but a plausible root cause is internal sentiments (e.g. a concern with procedural fairness or ex-ante fairness, i.e. fairness on average) as opposed to signaling to others. Our experimental results motivate very recent choice-theoretical models that can accommodate the observed behavior.

Appendix – Instructions basic social good experiment

Welcome to this experiment. You can earn money in this experiment. At the end of the experiment, you will be paid in cash according to your decisions and the decisions of the other participants. Each participant receives a payment of 5 Euro. Your additional payments are explained in these instructions.

During the whole experiment, you are not allowed to speak to other participants, to use cell phones, or to start any other program on the computer. If you have questions, please raise your hand. An instructor of the experiment will then come to your seat to answer your questions.

During the experiment, we do not speak of Euros but of the fictitious currency "Taler". At the end of the experiment, your actual amount of Taler will be converted into Euro according to the following exchange rate:

$$1 \text{ Taler} = 0.50 \text{ Euro}.$$

The payment at the end of the experiment is anonymous. This means, no participant is informed about the payment of the other participants.

In this experiment, half of the participants are in **role A** and the other half in **role B**. The roles have been assigned randomly.

Course of the experiment:

In the beginning of the experiment, each participant in role A (participant A) is randomly matched with another participant B.

No participant learns during or after the experiment which other participant was matched with him.

Participant A decides, which payment he himself and his matched participant B receive in this experiment. There are the following options:

- Participant A receives 15 Taler, and participant B receives 0 Taler.
- Participant A receives 10 Taler, and participant B receives 10 Taler.
- The computer chooses randomly one of the two aforementioned options. Both options are *equally* likely.

Participant B does not make a decision which affects his own or participant A's payment. He answers several hypothetical questions. His answers are irrelevant for the payment and are not told other participants.

Participant A also answers several hypothetical questions after his decision. His answers are irrelevant for the payment and are not told other participants.

End

Finally, each participant B is informed which of the three aforementioned options participant A has chosen. In addition, all participants are informed about their payment in the experiment. This ends the experiment.

Appendix – Instructions mug experiments

The introductory part of the instructions is exactly as in the social good experiment besides two changes: The show-up fee is not mentioned and instead of “half of the participants are in **role A** the other half in **role B**”, we say “some of the participants are in **role A** and some in **role B**”. Below we give the remaining part of the instructions. Those parts that are related to the voting experiment, which is not in our interest here, are in small italic fonts.

Course of the experiment:
In the beginning of the experiment, groups consisting of six participants are formed. Each group consists of five randomly chosen participants A and one participant B. No participant learns during or after the experiment which other participant was matched with him.

Each participant A has an endowment of 20 Taler; each participant B has an endowment of 0 Taler. In each group, the participants A vote on the following two alternatives. The alternative that gets the majority of votes in a group determines the payoffs of all participants in this group.

Alternative 1:
Each participant A gives up 6 Taler. For each participant A, the payoff reduces to 14 Taler, but the payoff of participant B increases to 14 Taler.

Alternative 2:
Each participant A gives up 0 Taler. For each participant A, the payoff remains 20 Taler, and the payoff of participant B remains 0 Taler.

Each participant A has one vote. The alternative which receives most of the votes is implemented for the group. Participant B makes a hypothetical decision which is not payoff relevant. All participants answers several hypothetical questions[...].

In addition, each participant receives a fixed payment. He can choose between the following three options:

He can choose to receive 15 Taler or to receive 10 Taler and a mug (including tea), or that the computer randomly chooses one of the two aforementioned options. Both options are *equally* likely.

End:
Finally, each participant is informed which alternative is implemented for his group and his payment in the experiment. This ends the experiment.

Appendix – The coffee mug in the mug experiments

Acknowledgments: The authors thank Michèle Belot, Shachar Kariv, Alexander Koch, Martin Kocher, Ehud Lehrer, Axel Ockenfels, and Klaus Schmidt for helpful comments. Financial support from LMUexcellent, the National Science Foundation, grant SES-0922404, and SFB/TR 15 is gratefully acknowledged. The authors kindly thank MELESSA of the University of Munich for providing laboratory resources.

References

Allais, M. 1953. "Le comportement de l'homme rationnel devant le risque: Critique des postulats et axiomes de l'ecole Americane." *Econometrica* 21:503–46.

Andreoni, J., and J. Miller. 2002. "Giving According to GARP: An Experimental Test of the Consistency of Preferences for Altruism." *Econometrica* 70:737–53.

Andreoni, J., and B. D. Bernheim. 2009. "Social Image and the 50–50 Norm: A Theoretical and Experimental Analysis of Audience Effects" *Econometrica* 77:1607–36.

Bartling, B., and U. Fischbacher. 2011. "Shifting the Blame: On Delegation and Responsibility." *Review of Economic Studies* 79:67–87.

Battigalli, P., and M. Dufwenberg 2009. "Dynamic Psychological Games." *Journal of Economic Theory* 144:1–35.

Bohnet, I., F. Greig, B. Herrmann and R. Zeckhauser. 2004. "Betrayal Aversion: Evidence from Brazil, China, Oman, Switzerland, Turkey, and the United States." *American Economic Review* 98(1):294–310.

Bohnet, I., and R. Zeckhauser. 2004. "Trust, Risk and Betrayal." *Journal of Economic Behavior and Organization* 55:467–84.

Bolton, G., J. Brandts, and A. Ockenfels. 2005. "Fair Procedures: Evidence from Games Involving Lotteries." *The Economic Journal* 115:1054–76.

Bolton, G., and A. Ockenfels. 2000. "ERC A Theory of Equity, Reciprocity and Competition." *American Economic Review* 90(1):166–93.

Bolton, G., and A. Ockenfels. 2010. "Betrayal Aversion: Evidence from Brazil, China, Oman, Switzerland, Turkey, and the United States: Comment." *American Economic Review* 100:628–33.

Borah, A. 2009. "Other Regarding Preferences in Environments of Risk." Mimeo, University of Pennsylvania.

Brock, M., A. Lange, and E. Ozbay. 2013. "Dictating the Risks – Experimental Evidence on Norms of Giving in Risky Environments." *American Economic Review* 103:415–37.

Broom, J. 1984. "Uncertainty and Fairness." *The Economic Journal* 94:624–32.

Camerer, C., and T-H. Ho. 1994. "Violations of the Betweenness Axiom and Nonlinearity in Probability." *Journal of Risk and Uncertainty* 8:167–96.

Charness, G., and M. Dufwenberg. 2011. "Participation." *American Economic Review* 101:1211–37.

Charness, G., and M. Rabin. 2002. "Understanding Social Preferences with Simple Tests." *The Quarterly Journal of Economics* 117:817–69.

Chew, S., and J. Sagi. 2006. "Event Exchangeability: Probabilistic Sophistication without Continuity or Monotonicity." *Econometrica* 74–73:771–86.

Chew, S. H. 1983. "A generalization of The Quasilinear Mean with Applications to the Measurement of the Income Inequality and Decision Theory Resolving the Allais Paradox." *Econometrica* 53:1065–92.

Cooper, D., and J. Kagel. 2013. "Other Regarding Preferences: A Selective Survey of Experimental Results." In *The Handbook of Experimental Economics*, vol. 2, edited by J. Kagel, and A. Roth. Princeton, NJ: Princeton University Press.

Dana, J., D. M. Cain, and R. M. Dawes. 2006. "What You Don't Know Won't Hurt Me: Costly (but Quiet) Exit in Dictator Games." *Organizational Behavior and Human Decision Processes* 100:193–201.

Dana, J., R. A. Weber, and J. X. Kuang. 2007. "Exploiting Moral Wiggle Room: Experiments Demonstrating an Illusory Preference for Fairness." *Economic Theory* 33:67–80.

Dekel, E. 1986. "An Axiomatic Characterization of Preference under Uncertainty: Weakening the Independence Axiom." *Journal of Economic Theory* 40:304–18.

Diamond, P. A. 1967. "Cardinal Welfare, Individualistic Ethics, and Intertemporal Comparisons of Utility: Comment." *Journal of Political Economy* 75:765–6.

Ellsberg, D. 1961. "Risk, Ambiguity, and the Savage Axioms." *Quarterly Journal of Economics* 75:643–69.

Fehr, E., and K. Schmidt. 1999. "A Theory of Fairness, Competition, and Cooperation." *The Quarterly Journal of Economics* 114:817–68.

Fischbacher, U. 2007. "z-Tree: Zurich Toolbox for Readymade Economic Experiments." *Experimental Economics* 10(2):171–178.

Fishburn, P. 1988. *Nonlinear Preference and Utility Theory*. Baltimore, MD: Johns Hopkins University Press.

Fudenberg, D., and D. K. Levine. 2012. “Fairness, Risk Preferences and Independence: Impossibility Theorems.” *Journal of Economic Behaviour and Organization* 81:606–12.

Gneezy, U., J. A. List, and G. Wu. 2006. “The Uncertainty Effect: When a Risky Prospect is Valued Less than Its Worst Outcome.” *The Quarterly Journal of Economics* 121(4):1283–309.

Grant, S. 1995. “Subjective Probability without Monotonicity: Or How Machina’s Mom May also Be Probabilistically Sophisticated.” *Econometrica* 63–61:159–89.

Grant, S., A. Kajii, B. Polak, and Z. Safra. 2010. “Generalized Utilitarianism and Harsanyi’s Impartial Observer Theorem.” *Econometrica* 78–6:1939–71.

Greiner, B. 2004. “An Online Recruitment System for Economic Experiments” in Forschung und wissenschaftliches Rechnen 2003, GWDG Bericht 63, eds. Kurt Kremer and Volker Macho. GesellschaftfŁuer Wissenschaftliche Datenverarbeitung, GŁoettingen: 79–93.

Gul, F. 1991. “A Theory of Disappointment in Decision Making under Uncertainty.” *Econometrica* LIX:667–86.

Hamman, J., G. Loewenstein, and R. A. Weber. 2010. “Self-interest Through Delegation: An Additional Rationale for the Principal-Agent Relationship.” *American Economic Review* 100:1826–46.

Harsanyi, J. 1955. “Cardinal Welfare, Individualistic Ethics, and Interpersonal Comparisons of Utility.” *Journal of Political Economy* 63:309–21.

Harsanyi, J. 1975. “Nonlinear Social Welfare Functions: Do Welfare Economists Have a Special Exemption from Bayesian Rationality?” *Theory and Decision* 6:311–32.

Harsanyi, J. 1978. “Bayesian Decision Theory and Utilitarian Ethics.” *American Economic Review* 68:223–8.

Kahneman, D., J. Knetsch, and R. Thaler. 1990. “Experimental Tests of the Endowment Effect and the Coase Theorem.” *Journal of Political Economy* 98(6):1325–48.

Kahneman, D., and A. Tversky. 1979. “Prospect Theory: An Analysis of Decision under Risk.” *Econometrica* 47:263–92.

Karni, E., and Z. Safra. 2002. “Individual Sense of Justice: A Utility Representation.” *Econometrica* 70:263–84.

Karni, E., T. Salmon, and B. Sopher. 2008. “Individual Sense of Fairness: An Experimental Study.” *Experimental Economics* 11(2):174–89.

Keren, G., and M. C. Willemsen. 2009. “Decision Anomalies, Experimenter Assumptions, and Participants’ Comprehension: Revaluating the Uncertainty Effect.” *Journal of Behavioral Decision Making* 22(3):301–17.

Kirchsteiger, G. 1994. “The Role of Envy in Ultimatum Games.” *Journal of Economic Behavior and Organization* 25:373–89.

Krawczyk, M., and F. Le Lec. 2008. “Social Decisions under Risk. Evidence from the Probabilistic Dictator Game.” Mimeo, University of Amsterdam.

Levine, D. K. 1998. “Modeling Altruism and Spitefulness in Experiments.” *Review of Economic Dynamics* 1:593–622.

Maccheroni, F., M. Marinacci, and A. Rustichini. 2008. “Social Decision Theory: Choosing Within and between Groups.” Mimeo.

Machina, M. 1982. “Expected Utility Analysis without the Independence Axiom.” *Econometrica* 50:277–323.

Machina, M. 1987. “Choice under Uncertainty: Problems Solved and Unsolved.” *Journal of Economic Perspectives* 1:121–54.

Machina, M. 1989. “Dynamic Consistency and Non-expected Utility Models of Choice under Uncertainty.” *Journal of Economic Literature* XXVII:1622–68.

Neilson. W. 2006. “Axiomatic Reference-dependence in Behavior Toward others and Toward Risk. *Economic Theory* 28:681–92.

Ok, E., and L. Kockesen. 2000. “Negatively Interdependent Preferences.” *Social Choice and Welfare* 17:533–58.

Rydval, O., A. Ortmann, S. Prokosheva, and R. Hertwig. 2009.” How Certain Is the Uncertainty Effect?” *Experimental Economics* 12(4):473–87.

Quiggin, J. 1982. “A Theory of Anticipated Utility.” *Journal of Economic Behavior and Organization* 3:323–43.

Rohde, K. 2010. “A Preference Foundation for Fehr and Schmidt’s Model of Inequity Aversion.” *Social Choice and Welfare* 34:537–47.

Saito, K. 2010. “Preferences for Randomization – Ambiguity Aversion and Inequality Aversion.” Mimeo, Northwestern University.

Sandbu, M. 2008. “Axiomatic Foundations for Fairness-Motivated Preferences.” *Social Choice and Welfare* 31(4):589–619.

Spector, Y., M. Leshno, and M. Ben Horin. 1996. “Stochastic Dominance in an Ordinal World.” *European Journal of Operational Research* 93(3):620–7.

Starmer, C. 2000. “Developments in Non-expected Utility Theory: The Hunt for a Descriptive Theory of Choice under Risk.” *Journal of Economic Literature* XXXVIII:332–82.

Tadelis, S. 2008. “The Power of Shame and the Rationality of Trust.” Mimeo, University of California, Berkeley.

Trautmann, S. 2009. “Fehr-Schmidt Process Fairness and Dynamic Consistency.” *Journal of Economic Psychology* 30:803–13.

Weber, M., and C. Camerer. 1987. “Recent Developments in Modelling Preferences under Risk.” *OR Spektrum* 9:129–51.